



## ***Memorandum***

December 18, 2007

**TO:** Honorable Ted Stevens  
Attn: Kate Williams

**FROM:** Salvatore Lazzari  
Specialist in Energy and Environmental Economics  
Resources, Science, and Industry Division

**SUBJECT:** Possible Federal Revenues from Oil Development at ANWR and Nearby Areas

This memorandum is in response to your request for an estimate of the potential revenues to the United States Treasury from oil development of the coastal plain study area of the Arctic National Wildlife Refuge (ANWR) should Congress approve such development.<sup>1</sup> At your request, estimates of potential federal revenues are based on market oil prices — the price at which the ANWR output would be sold — of \$60, \$80, \$90, and \$100 per barrel.

In making the revenue estimates it is assumed that: 1) commercial quantities of oil will be found, currently an unknown; 2) current revenue provisions would be applied, e.g., bonus bidding, ad-valorem royalty of 12.5%, and so forth (except that, per your request, we did not assume the 90% Alaska, 10% federal split of current law, but rather a 50-50 split, as found in many current bills); and 3) all of the coastal plain would be available for leasing.<sup>2</sup>

Federal revenues would consist primarily of corporate income taxes on profits earned by oil producers from the production and sale of ANWR oil. As landowner, the federal government would also collect royalties from such production on federal lands, which are included in the estimates. Revenues from bonus bids from federal leases, and rents on undeveloped leases, however, are not estimated separately, although Congressional Budget Office (CBO) estimates of bonus bids are reported. In addition, the federal government would collect income tax revenues from the secondary feedback effects as a result of the stimulus to general economic activity. However, as we discussed, these revenues are not included here due to the difficulty in estimation over the projection time horizon. Estimates

<sup>1</sup> For background and a discussion of ANWR legislation and surrounding issues, see CRS Report RL33872, *Arctic National Wildlife Refuge (ANWR): New Directions in the 110<sup>th</sup> Congress*.

<sup>2</sup> In past Congresses (e.g., the 109<sup>th</sup> Congress), some bills have restricted ANWR development footprints to 2,000 acres, which might not be sufficient to provide access to the entire coastal plain of the Refuge. This analysis assumes production is permitted from the whole of the Coastal Plain. Native lands, and nearby state waters.

of technologically recoverable oil used in this memorandum include the resources from the federal lands, and assume the availability of resources in Native lands in the Refuge and offshore state lands.

The revenue projections below are very long-term forecasts of what might happen, and not what will happen, given the methodology and the posited assumptions. All of the data used in this estimation are provided by the U.S. Energy Information Administration (EIA), as documented in the footnotes. In particular, the oil production data in the May 2000 EIA report are based on the resource assessment estimated by the U.S. Geological Survey (USGS) in 1998.<sup>3</sup> Note also that, according to the EIA and the USGS, it would take between 7 and 12 years after congressional approval to commence production, if feasible, from the ANWR area. Further, production from the properties is projected to last at least 30 years.

Also, other major uncertainties, in addition to the production starting date and the lands that might be developed include: 1) the size of the underlying resource base, 2) the underlying field structure, 3) the costs of development, 4) the market price of oil, 5) the average effective tax rate, and 6) the terms of the authorizing legislation. Thus, revenue projections are highly uncertain. Projections of federal revenue represent totals over the entire recovery period, until oil resources are no longer recoverable. Thus, they do not take into account any increased recovery based on changed economic conditions or the annual flow of production.

Finally, the projections below exclude potentially large revenues from the development of natural gas, which according to probability analysis may exist in large quantities in the ANWR coastal plain (particularly the 1002 federal area).<sup>4</sup> Revenue projections from natural gas development are excluded because there is currently no way to transport the gas to market (no pipeline or other means of transportation).<sup>5</sup>

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<sup>3</sup> U.S. Department of Energy. Energy Information Administration. *Potential Oil Production from the Coastal Plain of the Arctic National Wildlife Refuge: Updated Assessment*. May 2000, SR/O&G/200-02; U.S. Department of Interior. U.S. Geological Survey. *Economics of U.S. Geological Survey's 1002 Area Regional Assessment: An Economic Update*. Open File Report 98-34, 1999.

<sup>4</sup> See CRS Report RL33872, *Arctic National Wildlife Refuge (ANWR): New Directions in the 110<sup>th</sup> Congress*.

<sup>5</sup> Building such a pipeline has been debated. But, even assuming a decision is made, it would take many years — at least 10 years, according to some estimates — to build such a pipeline and bring the gas to market.

**Table 1** summarizes the results of our estimation procedure, which is described in the remaining sections of this memorandum. It shows the projected increase in corporate income tax revenues and cumulative estimated royalties projected over the estimated life of the ANWR and other nearby properties — from the production and sale of the estimated technically recoverable reserves of oil. Tables 2 and 3 show the corporate tax revenues and royalties separately.

**Table 1** presents twelve projections (undiscounted in real, 2007 dollars), each corresponding to an oil price and production scenario. For instance, if producers were able to recover 10.3 billion barrels of oil over the life of the properties — and there is a 50-50 chance that the ANWR coastal plain contains this amount of oil (or more) — and if oil prices are \$90/barrel (the current market price) then the federal government is projected to collect nearly \$138 billion in revenues over the production period, estimated to be at least 30 years

**Table 1. Possible Cumulative Corporate Income Tax Revenue and Royalties from ANWR Coastal Area Oil (billions of 2007 \$)**

	Estimated Technically Recoverable Oil (billions of barrels)		
	At least 5.7 (prob. = .95)	10.3 (prob.= .5)	16.0 or more (prob. = .05)
Oil Price per Barrel (2007 \$)	Revenues (billions of 2007 \$)		
\$100	\$84.6	\$152.9	\$237.5
\$90	\$76.2	\$137.6	\$214.2
\$80	\$67.7	\$122.3	\$189.9
\$60	\$48.3	\$91.7	\$142.5

**Source:** Author's estimates based on EIA data (see text).

**Note:** These revenue projections represent values over the production period of approximately 30 years, and are not stated in present value terms, which would be smaller.

once production commences. This consists of nearly \$95 billion in federal corporate income taxes (**Table 2**), and nearly \$43 billion in federal royalties (**Table 3**). (Tables 2 and 3 are each presented below in the sections detailing the estimation procedure for corporate income taxes and royalties.) These estimates assume that all of the oil that is technically recoverable is also economically recoverable, which is not necessarily the case. The amount of economically recoverable oil depends on unknown variables such as market oil prices and oil finding costs. With regards to oil prices, the higher the price, the more the amount of economically recoverable resources approaches the magnitude of technically recoverable resources. Thus, the USGS 1998 production estimates used in this memorandum, which were made when oil prices were very low as compared to current oil prices (about \$10/barrel as compared with the current market price of \$90/barrel), might be low.

The development of the ANWR coastal plain area would also generate federal revenues in the form of bonus bids from the leases on federal lands, and income tax revenues from secondary feedback and multiplier effects from an expanding economy. Bonus bids have been estimated by the Congressional Budget Office for President Bush's FY2008 budget proposal to lease the ANWR coastal plain. According to these estimates, bonus bids would total \$6 billion between FY2008 and FY2017.<sup>6</sup> The additional federal income tax revenues (both individual and business) from the secondary economic effects are more difficult to estimate because they would depend on the annual expenditures generated by oil development, the geographic dispersion of those expenditures, and the state of the general economy at the time. Neither bonus bids nor income tax revenues from secondary effects are included in Table 1.

## Projected Corporate Income Tax Revenues

Increases in federal corporate income taxes (Table 2) would most likely represent the single biggest source of revenue for the federal government if oil were found and produced in ANWR. The basic methodology to estimate potential corporate income taxes is to multiply estimated domestic, pre-tax profits from the assumed oil production at ANWR, projected over the lives of the properties, by the estimated effective federal corporate income tax rate for the major integrated companies that would be expected to have an interest in developing ANWR.

Domestic, pre-tax profits are the difference between revenues (price times output) and production costs. Per your request, four hypothetical oil price scenarios are assumed (each in real 2007 dollars), reflecting the unpredictability (and volatility) of world crude prices: \$100/barrel, \$90/barrel, \$80/barrel, and \$60/barrel. It is important to underscore that these are hypothetical price scenarios and do not constitute projections of what crude oil prices are likely to be.

## Output

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<sup>6</sup> See U.S. Congress. Congressional Budget Office. *An Analysis of the President's Budgetary Proposals for Fiscal Year 2008*. March 2007. p. 16. Under the President's proposal, half of the bonus bid revenue would go to Alaska, and half would be retained by the federal government.

Estimated oil output is based on a report by the Energy Information Administration, which uses data provided by the U.S. Geological Survey.<sup>7</sup> This report estimates projected oil (and gas) output for the three areas of the geographic coastal plain (including areas outside the ANWR boundary) expected to be of interest to the oil industry should congressional approval be forthcoming. Within the Refuge these are: 1) the section 1002 area of federal lands;<sup>8</sup> 2) 92,000 acres belonging to Native Alaskan corporations; and 3) several thousand acres of Native allotments in various states of conveyance to individuals.<sup>9</sup> In addition, prospects for development of

**Table 2. Possible Corporate Income Tax Revenues from Successful ANWR Coastal Area Oil Development (billions of 2007 \$)**

	Estimated Technically Recoverable Oil Output (billions of barrels)		
	At least 5.7 (prob. = .95)	10.3 (prob. = .5)	16.0 or more (prob. = .05)
Oil Price per Barrel (2007 \$)	Revenues (billions of 2007 \$)		
\$100	\$58.3	\$105.4	\$163.7
\$90	\$52.5	\$94.8	\$147.3
\$80	\$46.7	\$84.3	\$130.9
\$60	\$32.5	\$63.2	\$98.2

Source: Author's estimates based on EIA data (see text).

Note: These revenue projections represent values over the production period of approximately 30 years, and are not stated in present value terms, which would be smaller.

<sup>7</sup> Energy Information Administration. *Potential Oil Production from the Coastal Plain of the Arctic National Wildlife Refuge: Updated Assessment*. May 2000, SR/O&G/200-02; U.S. Geological Survey. *The Oil and Gas Resource Potential of the Arctic National Wildlife Refuge 1002 Area, Alaska*. Survey Open File Report 98-34, 1999, Chapter EA (Economic Analysis).

<sup>8</sup> This area of federal lands is referred to as the "section 1002 area" because of a study required in §1002 of Alaska National Interest Lands Conservation Act (ANILCA, P.L. 96-487) of 1980. The current prohibition on oil and gas development in ANWR is in §1003 of ANILCA.

<sup>9</sup> The 92,000 acres belong to the Kaktovik Inupiat Corporation and the Arctic Slope Regional Corporation. The Native lands inside the ANWR boundary fall into three categories: approximately three townships of Native lands within the *geographic* coastal plain of the Refuge but outside the administratively defined 1002 area; one township of Native land also within the *geographic* coastal plain of the Refuge, but administratively part of the 1002 area; and a number of Native allotments scattered through the *geographic* coastal plain, with some concentrations along the coast and in the foothills. Offshore state lands are largely open to development, although the state and the federal governments have disputed precise boundaries. For legal background, see CRS Report RL31115, *Legal Issues Related to Proposed Drilling for Oil and Gas in the Arctic National Wildlife Refuge (ANWR)*, by Pamela Baldwin. The May 2000 EIA report considered only the 92,000 acres. See *Potential Oil Production from the Coastal Plain of the Arctic National Wildlife Refuge: Updated Assessment*. May 2000, SR/O&G/200-02, op. cit., p. vii.

Alaskan state lands (offshore lands outside the Refuge out to the 3-mile limit) are likely to be increased by onshore development and were included in this analysis. Under §1003 of the Alaska National Interest Lands Conservation Act (P.L. 96-487), all lands inside ANWR are closed to development unless Congress changes the law. Were oil and gas development authorized for the federal lands in the Refuge, development would also be allowed or become feasible on the nearly 100,000 acres of Native lands in the refuge, possibly free of any acreage limitation applying to development on the federal lands, depending on how legislation is framed.

According to the USGS assessment of possible oil in the three areas described above, there is a 95% probability there are 5.7 billion barrels or more of technically recoverable crude oil and natural gas liquids in the three areas, and a 5% probability that there are 16.0 billion barrels or more. USGS's mean estimate — 50% probability — is 10.3 billion barrels. About three fourths of the possible oil and natural gas liquids<sup>10</sup> are estimated to be under federal lands, and one fourth under Native Corporation lands and the adjacent offshore state lands.<sup>11</sup>

For each recoverable oil quantity and price combination scenario, federal corporate income tax revenue was arrived at by (1) multiplying the quantity times the price, (2) subtracting production costs (operating costs plus depreciation, depletion, amortization, and administration), and (3) multiplying the result by the average effective federal corporate tax rate on major U.S. energy producers.

## Production Costs

Projections of production costs were based upon annual financial data on oil and gas industry operations published by the EIA in its *Performance Profiles* reports covering the major U.S.-based energy producing companies.<sup>12</sup> An eleven-year average (for 1995-2005) was used to remove the volatility of profits over business cycles and fluctuations in volatile market oil prices to accurately reflect the long-term nature of oil development in the ANWR coastal plain, which, if successful, would be expected to produce oil for at least 30 years. Based upon the *Performance Profiles* data, production costs of domestic oil and gas producers averaged 69% of revenues over the 1995-2004 period and, consequently, net pre-tax profits for those companies averaged 31% of revenue.<sup>13</sup> That percentage was used to project net pre-tax profits from ANWR output over the life of the wells. The production cost percentage was based upon cost data for all domestic U.S. operations rather than just for Alaska, which are not available. Also, the costs reflect the consolidated operations of largely

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<sup>10</sup> For production calculations, natural gas liquids are considered to be equivalent to oil.

<sup>11</sup> U.S. Geological Survey. *Frontier Areas and Resource Assessment: the Case of the 1002 Area of the Alaska North Slope*. USGS Open File Report 02-119. Hereafter referred to as "Frontier Areas."

<sup>12</sup> Energy Information Administration. *Performance Profiles of Major Energy Producers (Issues 2005, 2004, 2002, 2000, 1998, and 1996)*. Data used are in the table that reports Income Components and Financial Ratios in Oil and Natural Gas Production for FRS Companies.

<sup>13</sup> Ibid.

major integrated producers, rather than just production operations. It was not possible to analyze factors that may increase production costs, but some may be important: aging infrastructure, and the effects of global warming on ice technologies may be expected to increase costs.

The effective federal corporate income tax rate also was estimated using EIA's *Performance Profiles*. Based upon data in those reports, the average effective tax rate for the years 1998-2004 was 33%. This was derived by subtracting from the U.S. federal tax any foreign tax credit (which would not be claimed on income from ANWR operations), and dividing by U.S. pre-tax income.<sup>14</sup> This effective tax rate probably is an upper bound; and the actual effective tax rate over the production horizon might end up being lower due to substantial industry investments in ANWR oil and gas development. Also, the estimation of the effective tax rate assumes that current legislation remains unchanged. Any future amendments to current tax laws could, of course, either lower or raise effective tax rates.

## Federal Royalties

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<sup>14</sup> The effective tax rates were based upon both non-vertically integrated companies and vertically integrated companies. The EIA data are not disaggregated.

Landowners typically collect royalties on minerals extracted from their lands by mineral operators and producers. Likewise the federal government earns royalties from production of oil and gas on federal lands, generally 12.5% of the oil and gas value. The federal lands in ANWR have been estimated by the USGS to contain 74% of the estimated technically recoverable reserves. (The remaining 26% of total recoverable oil resides in state and Alaska Native Corporation lands.)<sup>15</sup>

Current federal laws effectively allocate 90% of the royalties from oil and gas production on federal lands to the states; the federal government retains the remaining 10%.<sup>16</sup> However, in our revenue projections you have asked us to assume a 50-50 split of all royalties.<sup>17</sup> **Table 3** shows the projected total royalties accruing to the federal government over the expected productive lifetime of the ANWR federal leases. The same amount of revenues are projected to accrue to the State of Alaska. There would also be income to the State of Alaska regardless of whether economically recoverable oil is found. This is because even if no commercially recoverable oil is found, the State of Alaska would still get 1/2 of the bonus bids and rents over the short term (5-10 years) while the oil industry is searching for the oil.

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<sup>15</sup> *Frontier Areas*, op. cit.

<sup>16</sup> However, the manner in which royalties are split between states and the federal government differs. For all states except Alaska, direct royalties under the Mineral Leasing Act (MLA) are divided equally (50-50) between the state in which the deposits are located and the federal government. The MLA also provides that all states except Alaska also get back 40% from the Reclamation Fund (established by the Reclamation Act of 1902), in effect giving each state 90% of the royalties and the federal government 10%. Alaska does not receive allocations from the Reclamation Fund, so to equalize royalty treatment among the states, the Alaska Statehood Act and the Federal Land Policy and Management Act provide that Alaska's royalty share is 90% of the direct royalties (rather than 50%).

<sup>17</sup> Many but not all bills that would approve development of ANWR provide for a 50-50 division of the royalties. Some bills (e.g., H.R. 39 in the 109<sup>th</sup> Congress) have been silent on revenue distribution, and it is not certain how courts would rule on certain revenue provisions. For more information see: U.S. Library of Congress. Congressional Research Service. *Arctic National Wildlife Refuge (ANWR): Controversies for the 109<sup>th</sup> Congress*. CRS Report RL33523, July 7, 2006.



**Table 3. Projected Federal Royalties from Possible ANWR Oil on Federal Land Alone (billions of 2007 \$)**

	Estimated Technically Recoverable Oil from Federal Lands (billions of barrels)		
	At least 4.2 (prob. = .95)	7.6 (prob. = .5)	11.8 or more (prob. = .05)
Oil Price per Barrel (2007 \$)	Revenues (billions of 2007 \$)		
\$100	\$26.3	\$47.5	\$73.8
\$90	\$23.7	\$42.8	\$66.9
\$80	\$21.0	\$38.0	\$59.0
\$60	\$15.8	\$28.5	\$44.3

**Source:** Author's estimates based on EIA data (see text).

**Note:** These revenue projections represent values over the production period of approximately 30 years, and are not stated in present value terms, which would be smaller.